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Joanne Paul-Murphy

Clinical Interpretation of Pharmacokinetic and Pharmacodynamic Data in Zoologic Companion Animal Species **1**

Butch KuKanich

The treatment and prevention of pain in zoologic companion animals is difficult because of the lack of data available on the safety and efficacy of analgesics. Pharmacokinetic (PK)-pharmacodynamic (PD) studies integrate changes in drug concentrations and changes in the drug's effect. All experimental studies assessing the PDs of analgesics have limitations in animals, but the data provided by experimental studies are valuable in designing dosages. Placebo-controlled, randomized, and blinded clinical trials provide the best PK and PD data, but are rarely performed in major veterinary species because of the number of animals required for the study, lack of preliminary PK and PD data in a given species, species-specific differences in PK and PD, and ethical and toxicologic concerns. The usefulness and limitations as well as considerations for interpreting PK, PD, and controlled clinical studies are discussed. An example of allometric analysis of buprenorphine in mammals is also included.

Fish Analgesia: Pain, Stress, Fear Aversion, or Nociception? **21**

E. Scott Weber III

The increasing use of fish resources and a greater understanding of aquatic animal medicine demands providing evidence-based veterinary care for these animals. Because fish are aquatic as well as being pokilothermic, there are several unique anatomic and physiologic considerations that must be understood when working with these animals. Veterinarians need to adapt methodologies for examining, performing diagnostics, and treating fish patients to decrease stress, decrease fear, and avoid and/or decrease nociception. This article briefly defines stress, reviews and compares fish neuroanatomic pathways associated with nociception, discusses behavioral observations, summarizes current use of analgesics for fish patients, and concludes with the ongoing controversy regarding pain on this topic.

Analgesia in Amphibians: Preclinical Studies and Clinical Applications **33**

Craig W. Stevens

Preclinical studies of analgesia in amphibians or recommendations for clinical use of analgesics in amphibian species are extremely limited. This article briefly reviews the issues surrounding the use of analgesics in amphibians, starting with common definitions of pain and analgesia when applied to nonhuman animals. Nociceptive and endogenous opioid systems in amphibians are reviewed, and results of preclinical research on opioid and nonopioid analgesics summarized. Recommended opioid and nonopioid analgesics are summarized, and practical recommendations made for their clinical use.

Pain and Nociception in Reptiles 45

Craig Mosley

The ability of reptiles to “feel” pain and the significance of pain or nociception on physiologic homeostasis is an exceedingly complex question requiring integration of both physiologic and behavioral evidence. Until further information is available, it would seem most ethical for veterinarians to assume that reptiles are capable of feeling pain, and to treat or manage pain when there is reasonable evidence that pain is present. With increased information available regarding analgesic use in reptiles and with the heightened awareness of the importance of analgesia for zoologic companion animals, it is likely that more veterinarians will provide pain relief to their reptile patients.

Avian Analgesia 61

Michelle G. Hawkins and Joanne Paul-Murphy

Avian analgesia is now recognized as a critical component of avian medicine and surgery. The need to recognize pain and to provide pain relief is the first step, and many anecdotal therapeutic doses have been extrapolated from other companion animals. Several published research investigations, using several species of birds, have begun to provide avian analgesia therapeutic information for clinical application. The challenge is to continue pushing this research forward with appreciation that there are approximately 10,000 known species of birds, perhaps 200 species commonly kept as pets, and that each species has a range of behaviors as varied as their species-specific PKs and PDs to each analgesic drug.

Rodent Analgesia 81

Amy L. Miller and Claire A. Richardson

Rodents of all species are frequently kept as companion animals, with increasing client expectations for the care of their animals. Fortunately, specialist veterinary interest and information is now available for treatment of rodents. In the field of rodent analgesia particularly, much can be learned from the methods developed for preventing and alleviating pain in animals undergoing research studies in laboratories throughout the world. This article reviews advances in pain detection techniques in rodents and makes recommendations on analgesic agents that are available for the alleviation of pain.

Rabbit Analgesia 93

Linda S. Barter

With the increasing popularity of rabbits as household pets, the complexity of diagnostic and surgical procedures performed on rabbits is increasing, along with the frequency of routine surgical procedures. More practitioners are faced with the need to provide adequate analgesia for this species. Preemptive analgesia prior to planned surgical interventions may reduce nervous system changes in response to noxious input, as well as reduce postoperative pain levels and analgesic drug requirements. Concurrent administration of analgesic drugs to anesthetized rabbits undergoing painful procedures is warranted both pre- and intraoperatively as well as postoperatively. This article discusses the neuropharmacologic and pharmacologic aspects of pain in rabbits, and reviews current protocols for the use of analgesic drugs.

Pain Management in Ferrets 105

Hugo van Oostrom, Nico J. Schoemaker, and Joost J. Uilenreef

The growing popularity of ferrets as pets has created the demand for advanced veterinary care for these patients. Pain is associated with a broad range of conditions, including acute or chronic inflammatory disease, neoplasia, and trauma, as well as iatrogenic causes, such as surgery and diagnostic procedures. Effective pain management requires knowledge and skills to assess pain, good understanding of the pathophysiology of pain, and general knowledge of pharmacologic and pharmacodynamic principles. Unfortunately, scientific studies on efficacy, pharmacokinetics, pharmacodynamics, and safety of analgesic drugs in the ferret are limited. However, basic rules on the treatment of pain and mechanisms of action, safety, and efficacy of analgesic drugs in other species can be adapted and applied to pain management in ferrets. This article aims to make an inventory of what is known on the recognition of pain in ferrets, what analgesic drugs are currently used in ferrets, and how they can be adopted in a patient-orientated pain management plan to provide effective pain relief while reducing and monitoring for unwanted side effects.

Tramadol Use in Zoologic Medicine 117

Marcy J. Souza and Sherry K. Cox

Numerous analgesics are available for use in animals, but only a few have been used or studied in zoologic species. Tramadol is a relatively new analgesic that is available in an inexpensive, oral form, and is not controlled. Studies examining the effect of tramadol in zoologic species suggest that significant differences exist in pharmacokinetics parameters as well as analgesic dynamics. This article reviews the current literature on the use of tramadol in humans, domestic animals, and zoologic species.

Zoologic Companion Animal Rehabilitation and Physical Medicine 131

Jessica K. Rychel, Matthew S. Johnston, and Narda G. Robinson

Injury and illness in zoologic companion animals can lead to significant pain and debilitation. Recovery can be slow and sometimes frustrating. By augmenting recovery from trauma or disease with physical medicine and rehabilitation techniques, recovery can be more rapid and complete. Physical medicine techniques, such as massage, can augment recovery from a painful injury or surgery by reducing edema, improving postoperative ileus, and decreasing anxiety. Familiarity with the tools of rehabilitation along with focus on pain management, strengthening, and proprioception improve patient care.

Acupuncture for Zoological Companion Animals 141

Marilyn A. Koski

Research in complementary and alternative veterinary medicine (CAVM) has increased dramatically in recent years. Acupuncture represents the most commonly practiced and extensively researched of all the CAVM modalities. Acupuncture is considered a valid therapeutic mode of treatment that can be integrated into Western veterinary medicine for the treatment of large, small, and zoological companion animal patients, especially in the area of analgesia. This article is intended to provide a guide for the zoological companion animal practitioner to gain a basic understanding of acupuncture and its potential for use in the zoological companion animal patient.

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